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RAILROAD FARES.

Much has been said upon this topic, and yet we conceive that not half enough has been done. It is true that it is impossible in a short time to judge of all the effects and their amount, where fares have been reduced, yet on a well established line, it requires no very great sagacity to predict the permanent effect, when the experiment of reduction has been continued for some months.

Several circumstances have recently drawn our attention to this branch of railroad tactics and we design to throw out those hints which have occurred to us, rather for the sake of drawing out further remark, than from any desire to present any regularly dijected treatise of our own. We do this the more readily as we know that the experiment of reduction of fares has been extensively tried and the communication of the results would be instructive in a high degree.

From a notice in a recent English paper we perceive that on the Liverpool and Manchester Rail Road, individuals of great wealth have been known to prefer the lowest price cars, even when the difference was inconsiderable. On one occasion it was testified that one of the wealthiest bankers of Liverpool was found in the lowest class of cars—mere boxes—unprovided with either seats or shelter—while not a single individual was in those of the highest class.

We recollect to have seen something of this kind, on one of our rail roads, where there were two classes of cars. Those of the second class were quite as good as any we even wish to ride in. It is true that those of the first class were better. Nearly all the passengers were found in the second class cars while but a fewer chose to ride in those which being a little better cost half a dollar more. Now in this case the intention was to separate the passengers and leave the cars of one class free from any unpleasant company. It turned out, however, that the company was equally well behaved and we have no doubt equally respectable in both classes—

and while the object sought was not attained—we learned that people in all classes of society prefer the cheapest mode of travel, even in the face of trifling inconvenience.

Proprietors of Rail roads and Steamboats seem to be well aware of the increased travel and income, due to a reduction of fare—and on many occasions avail themselves of this principle—but they do not seem to remember that the plan judiciously pursued, will if permanent, add to the regular and established custom of the line. We have lately heard of cases of this kind, where the regular and constant customers of a road paying high fares and meeting with but few accommodations were mortified by finding the attendants of political meetings carried for 25 to 50 per cent less and the company making money even then. This is not as it should be, and that it is unprofitable will soon be proved by a corresponding decrease in the regular traffic of the road.

Some of our best managed and most profitable Railroads are those which, by a vigorous opposition, either by Stage or Steamboat or by both, have been compelled to reduce their fares—and where the experiment entered upon by compulsion has proved finally to be, the best and most judicious permanent policy.

Be this as it may, a reasonable reduction of fare is demanded by the spirit of the times must either he complied with or contended against to the great detriment of those entering into the unequal contest.

ATLANTIC STEAMERS.

Every day furnishes additional proofs of the ease, safety, and certainty of the navigation of the Atlantic by steam. Mr. Cunard has established his line of Steam packets to Boston and Halifax, and as yet they have proved the fastest boats of all engaged in the trade. The *Caledonia* arrived in Boston on the morning of the 3rd inst., having made the passage to Halifax in *eleven* days and thence to Boston in 31 hours which including 17 hours delay in Halifax makes the entire passage *thirteen* days. The *Acadia* another of three Steamers made her passage out in *ten* days from Halifax and *thirteen* from Boston.

The *President* from New York arrived out in *sixteen* days—having on board a heavy cargo. It appears that she had 2,500 barrels of flour, which by an effort on the part of Capt. Fayner, were entered at the custom house the day before the duty advanced 4 shillings per quarter. The result of course was a very handsome speculation on the part of the shippers, which would have been rather smaller had any other means of transportation been resorted to. And yet the President is by no means the fastest of the Steam vessels plying upon the Atlantic, still her time of making the passage is certain and not liable to contingencies of so great extent as in the case of packets.

A circumstance of recent occurrence, showing the rapidity as well as certainty of steam navigation, struck us so forcibly that we were positively

startled—familiar as such things have become. On remarking to a friend that we had not met him for some time past, we were surprised to learn that he had in the interim made a voyage to England, spent sixteen days in the country during which time he had been almost in every part of the Island and returned a fortnight since after an absence of 47 days!

This after all is not as remarkable as what is entirely within the bounds of possibility. A journey of five or six weeks will suffice to carry a Londoner to Niagara falls, the City of Washington, and after a trip of 1000 or 1500 miles in the United States back again, without being hardly missed from his accustomed places of visit. In the same time a New Yorker can visit St. Petersburgh—and before long it will not require a great extension of his journey, as far as time is concerned, to go to Constantinople or even Jerusalem or Cairo.

ERRATA.—In a communication from our friend J. E. B., in our last number of "Railroads v. canals and rivers," quoting J. Edgar Thompson, civil engineers opinion, *that a good railroad will be found to be not only the most* EXPEDITIOUS, *but the* CHEAPEST *artificial medium of conveyance at present known*,"—the article should close as follows:—

☞ With these facts before us, should we not pause, and examine into our canal policy? We ask Western New York to reflect on this subject, ere we are too deep in debt for *canals*, to *aid* railroads.

For the American Railroad Journal and Mechanics' Magazine.

REMARKS ON THE "LAWS OF TRADE." By Charles Ellet, Jr. Civil Engineer.—No I.

The determination of the toll proper to be charged on a canal or railroad, for the conveyance of those commodities which are uniformly distributed over the district traversed by the improvement, and which are not objects of competition for rival lines, is an interesting and profitable question for the application of the principles involving the "Laws of Trade." This toll ought to be adjusted with a view to revenue, and, at the same time, a proper regard to equity and to the promotion of the business,—conditions which require variations of the charges corresponding with the changes of position on the line where the trade is received, the price of freight, and other circumstances. But as it is usual with the directors of the public works of the country to fix an uniform charge per ton per mile, and apply it without reference to these circumstances, it is certainly important to know what that charge ought to be in order to produce the greatest revenue, and what is likely to be the consequence of departures from it. The examination of this subject will lead to some curious and not unimportant conclusions.

For the purpose of the investigation, let us designate by

Π the greatest tax for carriage which the commodity will bear;

δ the freight per ton per mile on the improvement;

c the toll per ton per mile;

$\mathfrak{C}=(c+\delta)$ the whole charge per ton per mile;

β the charge per ton per mile on the lateral roads by which trade is conveyed to or from the line; and by

x the distance the commodity is transported on the work.

We shall then have the expression

$$\frac{\Pi}{\mathfrak{C}}$$

for the number of miles which the article will bear to be conveyed on the improvement; and

$$\frac{\Pi-x\mathfrak{C}}{\beta}$$

for the distance which it will bear to be carried laterally to or from the work. The tonnage which reaches the line at any distance x from the mart will be proportional to this expression; and since it is supposed to be furnished by the country on both sides of the improvement, will be represented by

$$T=2t\frac{\Pi-\mathfrak{C}x}{\beta}.$$

The revenue of the work due to the passage of this tonnage, obtained from the distance dx, will be

$$2t\frac{\Pi-\mathfrak{C}x}{\beta}cxdx;$$

t standing for the number of tons furnished by each square mile of the county traversed by the lateral road. By integrating this expression we obtain for the revenue of any distance x

$$r=\frac{3\Pi x^2-2\mathfrak{C}x^3}{3\beta}tc.$$

The greatest distance which the commodity will bear to be conveyed along the line has already been stated at $\frac{\Pi}{\mathfrak{C}}$; so that if we substitute this value in place of x in the equation, we shall obtain

$$R=t\frac{\Pi^3 c}{3\beta(c+\delta)^2},$$

for the aggregate revenue which can be derived from the conveyance of the article in question.

This equation is general, and independent of any particular value which might be given to the charge; but to arrive at the most profitable toll we must seek that value of c which will render this expression of the revenue the greatest possible, or $\frac{c}{(c+\delta)^2}$ a maximum. Treating this quantity by the rules of the calculus, we find for the condition of its maximum value

$$c=\delta;$$

that is to say, *to attain the greatest possible revenue from the trade, under an uniform charge, the toll must be just equal to the freight;* or the profit

received from each ton must be just equal to the expense of its carriage.

It may be repeated, that this result applies only to those articles which are designated as of heavy burden and small value; and that, in deducing it, we have regarded as "freight" all expenses incurred in the transportation of one ton, and as "toll" the profit which it yields to the work.

By comparing this result with that which is obtained in the general examination of the most advantageous charge, where the condition of absolute uniformity is not prescribed, we remark an essential difference. There the resulting toll is a function of the charge which the commodity will sustain, of the distance it is carried on the line, and of the charge for freight. In the present case, it varies only with the cost of conveyance, and is independent both of the value of the article, and the position, with reference to the mart, where it attains or passes from the improvement.

BOSTON CONNECTED BY RAILWAYS, WITH ST. LOUIS—ALSO THE COTTON, FLOUR AND PORK MARKETS, WITH THE MANUFACTURES OF NEW ENGLAAD.

The following article from a New Orleans paper should claim the attention of the citizens of New York, and induce united efforts to perfect a line of railways from this city to intersect at Albany a *continuous line* from Maine, to the *central city*, of the valley of the Mississippi.

"The enterprise of connecting St. Louis (in Missouri) with Boston, by a chain of rail-roads, is going forward with prospects of speedy accomplishment. The whole line of the road is already chartered. The distance from St. Louis to Boston is about twelve hundred and seventy-five miles. Of this will be completed next year from Boston to Buffalo, five hundred and thirty-five miles—in Ohio. on the shore of Lake Erie, sixty-three miles—in Michigan, near the south line, sixty-five miles—total, six hundred and sixty-three miles; making more than half the whole distance, and embracing two-thirds of the whole expense. The works in the west are for the present suspended by the want of funds, but it is expected that operations will be resumed actively at an early date. Here is enterprise exhibited on as grand a scale as the wildest fancy could have imagined. Ten years ago a plan to connect Boston with St. Louis would have been regarded as visionary as a scheme to bridge the Atlantic ocean. But a few more years will witness the accomplishment of the project, and the extension of the road perhaps many miles westward. *We are not surprised that the citizens of New York manifest so much alarm at the rivalry of Boston.* She is rapidly extending her arms into the great interior of the west. A line of steamers connects her with Europe, and a population unsurpassed for intelligence and enterprise will profit to the utmoet extent, from the facilities which the inventions and improvements of modern times lend to the extension of commerce."

The remaining half of the line, from Boston to St. Louis, (*by water,*) to wit,—from Buffalo via. lake Erie, Toledo, and the Wabash canal, to the Ohio river, will be in operation, at the close of the year 1841. Canals, however, it would appear, does not satisfy Massachusetts, from her past experience. Canals are not adapted to latitudes, where they can only be used six and a half, to seven months in the year. This is more particularly

the case since the late improvements in the locomotile engine, permits the transit of every class of merchandize, at cheap rates, with *celerity* and *certainty, at all seasons* of the year To use the language of Gen. Dearborn—"Massachusetts has turned her eagle gaze westward." "This link, (speaking of the western railroad,) "in the lengthened chain of intercommunication unites the pier heads of Boston harbor, and the port of St. Louis—the ocean with the Mississippi." * * * "How imposing is the subject." To carry these enlarged views into execution, the statesmen of Massachusetts have quietly matured their plans, and they have provided the means to carry them into execution. Does Albany want money to connect the outlet of the Erie canal, and the western railroad, with the *pier heads of the long wharf*, named after her? instantly her bonds, to the extent of $650,000 are cashed, and their engineers and agents are sent into our State to make a railroad, to turn our trade to Boston. Does Buffalo want $250,000 to complete "*the terminating link, to reach lake Erie from Attica?*" forthwith a meeting is called of the citizens of Boston, and they provide the means to control the two extremes of our State. What is the object of this liberality? The answer is obvious—to divert by her agents at Buffalo and at Albany, the western trade to Boston, the *great manufacturing emporium* of New England.

We may truly ask how long our Rip Van Winkles will be content to dream, that our State Treasury can furnish means to build the New York and Albany railroad, or further aid the New York and Erie railroad, whilst our statesmen, (without regard to party) remain wedded entirely to our canal system. Works, the construction of which, we assert, will absorb every dollar the state can raise, the next six years, and even when finished, they will remain monuments of the folly of the age, whilst our neglect of railways, is making us the laughing stock of our neighbors.

This view is not hastily presented. It is given after examination into the expense, profits and cheapness of transportation of merchandize by railways, on all great *thoroughfares.* This is particularly the case where there is a dense population on the line of the road, with large cities at the extremities. The longer the line, the greater will be the profit to the link terminating on the sea board, as in the case of the Boston and Worcester railroad; the New York and Albany; the Columbia, the Baltimore and Ohio, and other railroads leading from the sea, to the interior. They must all be profitable, and are destined to change the the course of transportation, of valuable articles. J. E. B.

REPORT OF JAMES RENWICK, L. L. D., ON THE MODE OF SUPPLYING THE ERIE CANAL WITH WATER FROM LOCKPORT TO THE CAYUGA MARSHES.

Columbia College, New York,
4th, September, 1839.

The Hon. F. Whittlesey, Rochester:

In compliance with the request in your letter of the 26th July, I proceeded to the western part of the State for the purpose of examining the

question therein submitted to me, viz.: "What means shall be adopted for the purpose of rendering it certain that the Erie canal shall be wholly fed from Buffalo to the Cayuga marshes without the necessity of taking water from the Genesee river?" In pursuing this inquiry I have received great assistance from the free and frank communication of Nathan S. Roberts, Esq. and Alfred Barrett, Esq. the chief engineers of the two sections of the canal within which the works involved in the question are situated, and from Mr. John Hinds, the superintendant of the Lockport division. In addition, the manuscript reports of the engineers just named were politely placed at my disposal by the Hon. S. B. Ruggles, one of the boards of canal commissioners. I have thus been enabled to consider the question fully in all its bearing, and have arrived at the satisfactory result, that if it be not possible, without making changes in the route of the canal that would be to injurious to existing improvements to be even thought of, to supply the canal as far as the Cayuga marshes directly from lake Erie, still it is possible to effect such supply without drawing water from the Genesee river at seasons when the stream is low, and the whole of it barely sufficient for the supply of the mills. On my arrival at Rochester the first point to which I turned my attention was to ascertain the quantity of water then running in the canal to the eastward, for this purpose the velocity of the canal was measured between the Genesee feeder and the first lock, (No. 1.) The velocity, when reduced to a mean was 24,675 feet per minute, and the discharge 3850 cubic feet. This discharge it was found was effected in part by overflowing at the gate of the lock, and in order to cause this overflow, the depth of water in the aqueduct instead of 4 feet was found to be 4 feet 6 inches.

The superficial velocity of the water in the Genesee feeder was found to differ but little from that in the canal, and it was inferred that all the quantity of water which appeared to be flowing in the canal was drawn from the Genesee river. No farther inquiry on this head was necessary for on proceeding to the Rochester aqueduct, a gentle but decided current was found setting to the westward, showing that the feeder not only supplied all the eastern section, but that a part of the water to the west of Rochester was also drawn from it. It was therefore obvious that no part of the water which descends at Lockport from the lake level reached Rochester, and that the whole supply of the canal to the east of the last mentioned place was at the time of the observation, derived from the Genesee river. According to the best information, such had uniformly been the case, except for a few weeks soon after the completion of the canal, and on certain occasions when the Genesee feeder had been closed for the purpose of repair. Of the latter, an instance which occurred in the summer of 1838, was cited. The Genesee feeder being closed by an embankment, the level of the canal fell until its depth became no more than 2½ feet, beyond which it seemed impracticable to raise it by the flow of water from lake Erie. The same general fact that the water cannot be kept at the lock east of Ro-

chester, within 12 or 18 inches of its proper level when the Genesee feeder is closed is stated in the report of the engineers. The effect of filling the canal by water from the Genesee feeder until it shall overflow at the gate of lock No 1, and stand six inches above its conventional level will be understood, when we consider that the slope of the bed of the canal is half an inch per mile. This rise of six inches will therefore back the water up the canal for a distance of 12 miles, and there will be two conflicting currents, under the action of which, what remains of the water that has been drawn from lake Erie, is forced over a waste wier about two miles to the westward of Rochester, and may be accompanied by a portion of that drawn from the Genesee river. Indeed it may be believed, that the latter is the largest part of what escapes at this waste weir, for the discharge from the weirs between this point and Lockport may at times account for all the water which comes down from the lake level. In this case, not only will be the canal to the eastward of Rochester, derives its whole from the Genesee river, but the waste and leakage for several miles to the westward will be furnished from the same source.

To test this question the currents were examined while making a passage from Rochester to Lockport, and it was found that there was no perceptible current to the eastward until after passing Spencer's basin, 12 miles to the westward of Rochester.

On speaking on this subject with Professor Dewey, he intimated that the western flow of the water in the acqueduct was too familiar an occurrence to excite surprise, and it was to be inferred that he had never noticed it running in a different direction. It may therefore be assumed as an established fact that up to the present time it has been the usual practice of the lock keepers to derive the whole supply of the canal to the eastward of Rochester from the Genesee river; and that in so doing, by forcing it over the lock-gates, the waste and leakage of some miles to the westward has also been furnished from the same source. According to the estimates of the engineers, this has amounted to 100 cubic feet per mile, or 5600 cubic feet per minute for the distance from Rochester to the Cayuga marshes. If these estimates of expenditure be correct, and they would appear to rest on sufficient evidence. This large quantity of water has unquestionably been continually drawn from the Genesee river. How far this may constitute a ground for a claim of indemnity on the part of the owners of the mills is a question into which it is not my province to enter, but there can be no doubt that in seasons of drought they must have sustained most serious injury.

It being thus ascertained that the whole of the canal to the eastward of Rochester, was actually fed from the Genesee river, it was a matter of doubt whether this were rendered necessary by the circumstances of the case, or arose from defective management. A visit to Lockport and Buffalo showed the lake level of the canal at its full depth, while the discharge through the locks was sufficient to keep the canal overflowing at every waste weir.

Finally, within two miles of Rochester, is, as has been remarked, a waste weir, over which a large quantity of water was found constantly pouring. It was intended to have guaged this weir, but the experiment now to be cited was considered of sufficient importance to be preferred.

In consequence of suggestions to the same effect with the foregoing remarks, the gates of the Genesee feeder were closed for the purpose of testing by experiment, whether water from lake Erie could, in the present condition of the canal, reach and be available at Rochester. Provision was made for passing water into the levels beneath without forcing it over the lock-gates. The water in the aqueduct fell speedily from a depth of 4 feet 6 inches to 4 feet. A current now set from the westward, and flowed constantly through the aqueduct. This current was observed by me for about eight hours, during which time there was no farther perceptible reduction in the depth of water in the aqueduct. After twelve hours, however, it became necessary to admit vessels from the Genesee river through the feeder, and the experiment could no longer be persevered in. It appeared also that some vessels had taken the ground in the basin at the junction of the feeder, showing a greater diminution of depth to the eastward of the aqueduct than in the aqueduct itself. From that time, for the next four days, a partial supply was admitted from the river, but not in such a manner as to raise the water in the aqueduct beyond the depth of four feet.

This experiment was commenced without notice or concert, but it is believed that the banks and weirs between Rochester and Lockport, were in better order than has been usual. It may be considered as having conclusively settled the question whether waterand be brought on the canal in its present state, from lake Erie to Rochester in the affirmative, as having proved that the quantity is sufficient for all intermediate objects, and that a surplus is left applicable to the supply of the lower levels; but it may also be considered as proving that this surplus is not sufficient for the latter object. It seemed to be admitted that these levels could not have continued to be supplied had not the Genesee feeder been opened, and it was kept partially open although the current was still directed eastward through the aqueduct. We may therefore assume that it not only has not been usual to draw any part of the supply of the canal to the eastward of Rochester from lake Erie, but that with the canal in its present state it has been impossible to derive the whole of such supply from that distant source. Whether this be an absolute physical impossibility, or whether it arise from errors in the original plan of the canal, from natural causes acting to impair it from faults in its execution, or from defects in the manner in which it has been managed, must be examined before we can proceed to point out the ameliorations in these several directions of which the canal is susceptible.

The quantity of water which it is estimated by the state engineers is consumed by the levels east of Rochester is 5600 cubic feet per minute.

The area of the present canal is 136 feet. The water, therefore should

have a mean velocity of 41.2 feet per minute or 2472 feet per hour. Calculating the proper slope for such a velocity in a canal of the given dimensions, by means of Eytiwein's formula, it would appear to require 1.3 in. per mile, and by the formula of Prony 1.4 in. The slope allowed in the construction of the canal is no more than half an inch per mile. We cannot err therefore, if we assert that the slope of the present canal is little more than one third of what it ought to have been in order to maintain a steady flow of as much water as it is said is used on the canal east of Rochester from Lockport to that place. It is farther to be remarked that each of the 64 miles between Rochester and Lockport, is estimated to consume its 100 cubic feet per minute, and that this ought to be met, either by giving to the canal at the points near Lockport a greater sectional area, or a greater slope.

Were it not that the main object of this report is to point out the means of remedying existing defects, and of preventing their occurrence in the enlarged canal, it would be unnecessary to proceed farther. In this single and prominent cause is to be found a reason all sufficient why the main supply of the canal east of Rochester must have always been drawn from the Genesee river, and this much continued to be the case in the enlarged canal, unless it have a slope and volume adapted to its own wants. The error in management by which not only the whole supply east but that of several miles to the westward of Rochester has usually been drawn from the Genesee river has been already referred to, but although this may be corrected, and no water passed westward through the aqueduct, much of the eastern supply must continue to draw from the river so long as the canal retain its present slope and dimensions. In enlarging the canal a less slope will suffice, the resistance being less in proportion in the larger channels, but in a channel of the area of the new aqueduct at Rochester, a slope of nine tenths of an inch per mile will be required to pass the water demanded for the lower levels. Continuing this same slope up to Lockport, it will amount in all to 57.6 inches, while the present slope is no more than 32 inches.

The descent from the lake level at Lockport, is effected by means of five combined locks, having an united fall of 60 feet. It is foreign to our present object to point out the general defects which attend the combination of locks into a system, instead of separating them by levels of the canal, or at least by extensive basins. It was, we are informed, believed that the mountain ridge could be passed in no other manner, and although a part of the difficulties which have attended this juxtaposition of the locks was foreseen, it was not believed that it was possible to adopt any other arrangement. This has had an unfortunate influence on the question before us. Had it been known to be possible or considered expedient to have divided the fall which is now accumulated at Lockport, and thus to have laid out the canal in four successive levels of 12 and 20 miles each, the defect in the slope of the bottom of the canal would not have produced so material a deficiency in the supply, for a small accumulation at the head of each level or depression

at its lower end would have caused a slope on the surface of the water in the canal sufficient to give the velocity necessary for the passage of the supply through it. But into a level of 50 or 60 miles, the water may be poured in sufficient abundance to overflow at every waste weir, and yet little more shall reach its lower extremity than if it had been barely kept up to its prescribed depth.

The accumulation of the locks at Lockport, preventing any adaptation of the slope of the surface to the supply acquired to be passed, and throwing this whole duty upon the slope of the bed of the canal may therefore be ranked among the prominent defects of the existing canal. Nor are the objections to a system of combined locks less when they are considered in other points of view. In order that they shall pass as much trade as a single isolated lock, it becomes necessary to have a double set, and thus twice as much water is introduced in lockage at one end of a level as it demanded for the same purpose at the other. If therefore there be no provision for husbanding this excess to meet the waste and lekage, at other points, it must be discharged over the nearest waste weir and then an excessive supply set down at Lockport, and overruning there with a velocity which exceeds the limits of 1-2 to 3-4 inch per hour prescribed by the Commissioners, a large proportion barely enters the Rochester had to be forthwith passed over a weir and all the residue is usually thrown out of the bed of the Canal before it reaches Spencer's basin.

Such is the quantity of water which is thus usually wasted, that mills are to be seen at various points on the line of the Canal, in steady operation, which have in some cases no other supply of water than that which runs over the weirs, and in others although placed on the line of a natural stream, the beds of most of those streams were found dry in the month of August.

Considered as a labour saving engine, a canal is viewed by those who confine themselves to the theory, as a machine, set in action by the water of a reservoir at its summit level, whence it receives it clear and pure, in quantities just sufficient for its lockage, and for the waste by leakage and evaporation; these quantities it conveys neither in excess nor defect to the place where they are respectively needed. In the New York Canals on the contrary, water has been derived from every possible and available source, poured in without measure, whether turbid or clear, to be again thrown to waste, after it has deposited its impurities in the bed of the canal. In other parts of the canal, the necessity of grasping every available stream may have really existed, but when Lake Erie was to be found at the summit no such reason can be assigned. Had the canal been vested in an incorporated company or been in any other hands than that of the sovereign power of the state, it could not have continued in use under the present system of management. The claims for damages for the diversion of waters in such quantities from their regular and ardent courses would have borne no small relation to the nett tolls, if they could have been brought before an impartial jury, nor would a corporation or individual have sub-

mitted to such claims where at least a part of the benefit is reaped by those who make use of the same waters, thrown to waste through another channel.

The worst feature in the present state of the canal is the power either of injury or of conferring benefit which is placed in the hands of subordinate agents. Thus the keeper of the first lock east of Rochester has it in his power by the manner in which he sends down the water to the lower levels, to determine whether the whole of the supply of the canal from Spencers basin to the Cayuga level shall be drawn from the Genessee river, or whether that river shall be required to furnish no more than is deficient in the quantity which is capable of making its way from Lockport. In other places it is possible by the management of a waste gate, to keep a mill in continual operation at the expense of the canal, or prevent it from working at all. Nor can it be credited that prudent men would have trusted to a supply to all appearance so precarious, as that of the mere waste of a canal, which in some places is complained of as insufficiently supplied, had there not been some reasonable assurance that this waste of water, so much wanted in other directions, should continue to be sufficient for their objects. Such is the condition of the present canal that an intelligent workman in a mill on the route, with whom I had a conversation, expressed it as his belief, founded on the experience, that the more water was required on the lower levels, the greater must necessarily be the waste on the upper. Paradoxical as this may appear, it is at the present moment, under the given slope of the canal and position of the waste wiers, true, for in attempting to send forward the desired quantity of water, the canal is filled at every point to overflowing, while, after all, the addition to the quantity which reaches Rochester would be insensible, even were the level kept low enough there to permit it to flow through the aqueduct.

The actual expenditure of water in the existing canal stated by the engineers at 100 cubic feet per mile per minute is due far more to the excessive discharge over the waste gates than to the causes usually assigned, of leakage and evaporation. There are indeed reasons why the loss from leakage should be greater on the line of canal between Lockport and Rochester than in other regions. The excavation in many cases extends downwards into a slaty rock, the joints of which are open and leave a free escape for water. These joints have never been secured by puddling or lining of any description. The soil is in most instances bad, being a light sandy loam. It appears probable, however, that these causes have ceased to be of much moment, for the very filtration of the water through the banks and bed of a canal tends to make them water tight. The nature of the soil, the admission of muddy water and the imperfect structure of the canal had, however, been the cause of an obstruction of no little moment not only to the flow of water from Lockport to Rochester but even to the navigation of the Canal. The bed of the canal has been formed in this loose friable soil of the same figure as was adopted throughout the whole

of the rest of the line, the sides having an inclination of 1 foot in 1 1-2 of breadth. This is far from being sufficient to sustain earth of this quality even if not exposed to the action of water. In the case before us it has been continually worn from the sides and deposited in the angles of the bed, until in the neighbourhood of Holley, the capacity of the canal has been so far diminished that two loaded boats cannot pass each other.

In connection with this obstruction may be cited another known by the boatmen under the name of *side bars.* These appear to be owing to the following cause. The canal is laid for a great part of the distance between Rochester and Lockport, on side lying grounds, and therefore in many cases there is a cut on its southern side. This is continually acted upon by the current, and the wave raised in it by boats, and earth is thus thrown into the canal. In addition, the surface water of the country to the south finds its way for the most part into the canal, carrying with it the loose earth and the wash of the fields. All streams, too, which intersect the line of the canal at a level sufficiently high, are permitted to flow into it, whether clear or turbid. There are in truth none of the arrangements for preventing the canal from being filled up, which have been tested by experience in Europe. The counterbank has never been finished. It has no berm to prevent the wash from its own face from falling down, no counterditch to exclude and carry off surface water, nor can either of these necessary parts to be found in their proper place even in connection with the towing path. Not the least curious observation is that the counterbank of the canal should be familiarly, named the berm from an important and essential feature which it ought to have possessed, but which is not to be found in any part of it. The flow of water through the canal is said in some seasons to be much hindered by the growth of a species of grass. This appears to have been a native of the shores of Lake Erie, and to be making gradual encroachments along the Canal. At the time I passed up, it appeared to have been recently cut, for the surface of the water in the canal was covered with it floating, yet withered. The superintendant of this section is of opinion that he has succeeded in discovering a mode by which the grass may be kept within bounds without difficulty. Still it is of the utmost importance that this should be done, and that it be satisfactorily shown that the cutting of the weed can be performed with certainty, for its presence will render all calculations on the velocity and discharge of the water erroneous.

The aqueduct at Rochester forms at the present moment a bar to the progress of the water Eastward. Its area is less than half that of the canal itself, and the canal on issuing from the aqueduct is bent nearly at right angles. It may thus happen, even when the canal west of the aqueduct, is fully supplied with water that a rapid lockage will leave that part between the acqueduct the lock East of Rochester so shallow as to require a supply from the Genessee river. In general, also, in all cases of frequent passages through a lock the level of the water in the upper reach of the canal is

drawn down unless the canal have a large surface in the immediate vicinity. This will be more particularly the case near the lock which closes a long level when there is no opportunity for increasing the velocity by a change in the slope of the surface caused by a swell or flush in the neighborhood of the lock next above it. So also when there is a defect of water in the lower levels, those above may be drawn upon too rapidly, and vessels caused to take the ground.

In the neighbourhood of the upper lock, the rapid discharge of water used in lockage, raises a wave, which does not for a time communicate its motion to the body of water in the reach when it enters. It will therefore require space to spread itself on an elevation in the banks and waste wiers, in order to prevent these sudden flushes from being unprofitably wasted. The causes which have been observed, as opposing or preventing altogether the flow of the waters from Lake Erie to the levels east of the Genessee river, having been thus premised, the remedies and changes which are necessary in any improvement or enlargement of the canal may be enquired into.

(To be Continued.)

We are gratified to have received from Mr. Vignoles, the following very interesting report of the North Union railroad. We publish it as a sample of the manner of stating railroad disbursements in England. We shall be happy to receive further reports from this gentleman as well as from the several railway companies in England and other parts of Europe, to diffuse information for mutual benefit.

EXTRACTS FROM THE REPORT OF THE DIRECTORS.

Although the act of incorporation of the north union railway company only contemplates the accounts being made up once in the year, in compliance with the wish of the proprietors expressed at the last general meeting, the directors propose to adopt the usual practice of doing so, and declaring a dividend *half-yearly;* submitting the accounts, and the dividend proposed to be declared, to meetings of their proprietors summoned every six months, at similar periods of the year to those of the railway companies generally.

In the statements of the company's accounts, the proprietors will notice that the expenditure on the capital account, that is in the completion of the railway itself, with all the stations, workshops, machinery, engines, carriages, tools, &c. &c. is kept altogether distinct from the receipts and disbursements in the traffic account, or that of the *working* of the railway.

The former account is fast drawing to a close, this railway having now been amply and very satisfactorily furnished with almost all that appears at present requisite for the efficient and economical working of the traffic; and, as regards its locomotive establishments, being even adequate to furnishing power to other connecting railway companies, on terms which it is anticipated will prove *mutually* beneficial.

As regards the traffic account, the proprietors will have pleasure in observing that, although the half-year ending the 30th June is well known not to be so favorable to railway receipts as that terminating on the 31st December, the receipts of the last half-year present a satisfactory comparison with those of the previous one, and have been very considerably more

than those of the corresponding period of 1839. The nett profit of the last half-year, including the surplus of 406*l* 11*s* 5*d* of the previous dividend, amounts to 16,396*l* 3*s* 4*d*; the directors would therefore propose that a dividend of 2*l* 10*s* per share (being at the rate of 6*l* 13*s* 4*d* per cent., per annum on the 75*l* share) be now declared, payable by warrant, at the company's bankers, on or after the 17th instant; leaving a surplus of 537*l* 13*s* 4*d* to be carried to the next half-yearly account.

The directors cannot close their report without stating distinctly to their proprietors, that they are far from considering the entire capabilities of the line as by any means fully developed. The Lancaster and Preston junction railway was only opened at the *close* of the half-year to which these accounts are confined, and the Preston and Wyre railway, which promises to be another very important feeder from its bringing into existence an entirely new traffic, has only been *subsequently* opened to the public; and in addition to these *new* sources of income, the continued increase in all the old branches of business experienced on every railway, may be anticipated with peculiar confidence on this, and most especially as regards the increasing conveyance of goods and coals.

Some inaccurate statements having been circulated relative to the *cost* of this railway, the engineer has prepared and appended to his report a detailed and authentic statement of all the particulars, which the Directors think it only justice to him to have circulated among the proprietors generally, and which is therefore annexed to the following accounts.

RECEIPTS, *&c. to the* 30*th* JUNE, 1840.

Coaching Department	$128,274 92
Coal Ditto	2,079 20
Merchandize Ditto	11,397 86
Rental Account	2,222 22
	$143,974 20
Profit and Loss Account, to 31st December, 1839	1,806 97
	$145,781 17

EXPENSES.

Coach Disbursement Account	$8,812 09
Locomotive Power Account	16,813 72
Office Expenses Account	923 09
Salary Account	3,791 55
Toll (to Liverpool and Manchester Co.) Account	31,954 94
Petty Disbursement Account	56 40
Interest Account	626 44
Interest on Loan Account	3,407 06
Tax and Rate Account	2,231 10
Chief Rents Account	194 07
Charge for Direction Account	1,333 33
Maintenance of Way	2,666 67
Compensation	14
Fire Insurance	11 67
Advertising	10 89
Repairs for Buildings	59 98
	72,907 08
Dividend of 50*s per Share on* 6329 *Shares is* 15,822*l* 10*s*.	$72,874 09

THEODORE W. RATHBONE, *Chairman.*

TO THE DIRECTORS OF THE NORTH UNION RAILWAY.

GENTLEMEN,

In drawing to a close the construction of the north union railway, I consider it will be satisfactory to the directors and proprietors to have the detailed cost of the several great heads of expenditure brought into one view before them. It is due to myself and the other officers of the company, that the quantity of work executed for the money should be set forth; and without any thing beyond a simple statement of facts in this respect I shall be content, should this report be promulgated, to leave the shareholders in this concern and the public to form their judgment. I likewise conceive that, as the first authentic detailed document of the kind, it may be taken as the commencement of similar statements which will hereafter be brought forward, and thereby be the means of collecting that statistical information on the railway system, which has naturally, and of late, been so much sought after.

It should be noted that the total length of line embraced herein is 25 miles; the main line from Parkside through Wigan to Preston being 22 miles, and the New Springs Branch 3 miles: and it should be observed, that from the peculiar nature of this Railway, the total extent of sidings, extra lines, &c., is very much above the usual proportion.

In the total sum of 578,931*l* 16*s* 2*d*, (say in round numbers $2,573,000,) is included the cost of re-laying the old line between Parkside and Wigan; the cottages now building along the line; the maintenance of the railway by the contractors, for two years, from the respective openings; and not only all that has been already expended on the several items, but that which is now in progress, or contemplated to be done, to make the railway complete, and to draw the line at the foot of *capital account*.

From a consideration of the nature of the works on this line, many of them of a gigantic character, particularly the Ribble Viaduct, and including the various slips and accidents, I hope I may be permitted to consider the average cost of $102,920 per mile as a moderate amount, including, as it does, Stations, Carrying Establishments, Interest, and Management.

The actual cost of the railway itself has been only $70,191,11 per mile, exclusive of land; and if the peculiarly heavy expense of the Ribble Viaduct (consisting of five arches of 120 feet span each, erected at a cost of about $199,481 including all contingent extras) be excluded, as it fairly might, for comparative results, the cost of the works alone is $62,213 per mile; the purchase of land for the railway is $8,773 per mile additional; $15,631 is the cost per mile for the stations and carrying establishments; and $8,342 per mile for interest and management. Separating the latter item from the interest, it will be seen that the whole expense of the superintendence of the north union railway, over a period of ten years of greater or less activity, has scarcely exceeded 7 per cent. This item is, of course, not in the engineer's department, but it is due to the managing officer of the company to state the circumstance: it will also be found that the average quantities per mile are—of earth work 116,120 cubic yards, averaging under 19 cts., per yard; of masonry, 4000 cubic yards, averaging $5,02 per yard; and of iron, 287 tons, averaging something below $43,33 per ton.

In respect to the mode in which the difficulties presented by the physical obstructions on the face of the country have been surmounted, by the adoption of gradients of 1 in 100 to a considerable extent, and thereby a vast saving effected in the construction of the railway, I hope to be able to demonstrate, at the close of the first two years' entire working of the line in

October next, that, with the exception of some very little addition to the quantity of fuel, the cost of working the north union railway, reduced to a rate per mile per train, is *below* that of other lines with superior gradients, while the trains and rate of travelling are at least equal to the averages elsewhere; and I feel confident of being able shortly to give a very close approximation of what that average expense is per mile per train, including all the deductions from the gross receipts, before declaring a dividend.

There being then but little difference, as far as observation and experience have hitherto gone, in the cost of working trains of passengers and light goods on railways, differing considerably in gradient, at velocities and with loads such as usually occur, *the high importance of economy in the first construction is self-evident.* It has thus told effectively on the grand junction railway, and I trust will be equally felt on the Midland counties railway, each of which lines, with similar equipments to those on the north union railway, will be found to have cost at about the same rate, or but little exceeding it, say certainly within 25,000*l* per mile. Reducing the whole expenses on the north union railway to round numbers and to a per centage, the account will stand as follows:

		Total.	Per Cent.	Per Mile.
	Earth Work	126,000	22	$22,200
	Masonry	120,000	21	21,300
	Fencing	21,000	3½	3,600
Upper Works.	Railway laid complete	61,000	10½	10,700
	Iron	67,000	11½	12,000
	Land and Damages	50,000	8½	8,900
	Stations	44,000	7½	8,000
	Carrying Establishment	44,000	7½	8,000
	Interest	5,000	⅘	900
	Management	42,000	7½	7,500
		580,000*l*	100	$103,100

But to enable a more critical examination to be made, I shall subjoin the following abstract:

ABSTRACT of the quantities and cost of the works upon the line of the north union railway—25 miles—with the general heads of expenditure in the various departments.

EARTH WORK	2,903,028 cubic yards, (average 10 2-5d per yard)		$558,560 87	
MASONRY AND BRIDGES.	100,265 cubic yards Masonry	502,043 98		
	325 tons Iron Work	17,222 22	534,438 91	
	25,022 cubic feet Timber	14,567 71		
FENCING AND DRAINS.	87,712 lineal yards.—*N. B. This includes Road Diversions, &c. Gates, &c. &c.*		91,258 35	
UPPER WORKS.	6,885 tons of Iron Rails and Chains.	297,026 14		
	91,545 lineal yards of railway laid on blocks & Sleepers, including Ballast, Drains, Walling, Bolts, Keys, Felt, Plugs, and small Materials and Labor.	273,502 26	570,578 40	
				$1,754,786 51
LAND AND DAMAGES.	320 acres for Railway.			219,290 63

STATIONS.	Land for Stations.	76,701 20		
	Station Buildings.	60,397 35		
	Warehouses.	41,182 22	196,791 11	
	Fixtures, Turnplates, and Sundries.	18,510 34		
				390,934 31
CARRYING ESTABLISHMENT.	Repairing Shops, Tools, and Fixtures.	52,817 78		
	Locomotive Engines, Tenders, &c.	83,837 01	194,143 20	
	Carriages, horse boxes, trucks &c.	57,488 41		
INTEREST.	Interest Account, Rates, Taxes, &c. &c.		21,096 81	
MANAGEMENT.	Parliamentary and Law Expenses.	76,260 67		028,010 80
	Engineering and Surveying.	27,525 72	166,963 98	
	Office Expenses, Travelling, Advertising, &c.	13,933 15		
	Salaries.	69,244 44		
TOTAL COST.			$102,921 21 per mile,—or—$2,573,030 25	

It should also be mentioned that, of the above land there remains to the value of about four or five thousand pounds available for re-sale; and, in conclusion, I trust that the dividend of nearly 7 per cent. per annum out of the clear profits of the railway, since its entire completion and opening throughout, in October, 1838, to the present time, with a prospect of a steady increase, is a sufficient proof of the soundness of the concern; and with my grateful acknowledgments to the directors for their invariable kind support amidst many trying difficulties, now happily surmounted,

I have the honour to subscribe myself,

Their very faithful Servant,

CHARLES VIGNOLES, *Engineer-in-chief.*

4, *Trafalgar-square, London, August* 4, 1840.

KITE'S PATENT SAFETY BEAM.

We take great pleasure in again presenting to our readers a new testimonial in favor of Mr. Kite's useful and humane invention. We call it humane, and it indeed is so, for there is no invention connected with railroads, that has been the means of saving so many lives as this.

It will be perceived from the testimonials, that in the cases of accident, the cars have been able to run the entire trip after breaking the axle. This circumstance alone would be an inducement to the use, of the safety beam, as much time and trouble are thereby saved.

Like many other useful contrivances intended to *prevent* danger, the safety beam, must wait until one or more painful accidents have rendered its introduction on any individual road, no longer to be delayed. The very safety it is intended to produce is apt, in unthinking minds, to beget an indifference upon the subject. Bearing this in mind, we shall not hesitate to renew, from time to time, our notices of this valuable invention, and nothing will give us more pleasure than to publish such testimonials as Mr. Kite may receive.

OFFICE OF THE PHILADELPHIA, WILMINGTON AND BALTIMORE RAILROAD CO.

Wilmington, Del., September 28, 1840.

☞ The undesigned take pleasure in attesting to the value of Mr. Jo-

seph S. Kite's invention of the safety beam axle and hub for railroad cars. They have for some time been applied to passenger cars on this road, and experience has tested that they fully accomplish the object intended. Several instances of the fracture of axles have occurred, and in such the cars have uniformly run the whole distance of the trip with entire safety. Had not this invention been used serious accidents must have occurred.

In short we consider Mr. Kite's invention as completely successful in securing the safety of property and lives in railroad travelling, and should be used on all railroads in the country.

JOHN FRAZIER, Agent.
JAS. ELLIOTT, Superintendant Motive Power.
GEORGE CRAIG, Superintendant,
W. L. ASHMEAD, Agent.

ST. LOUIS AND BOSTON.

The two cities of the United States which are progressing most rapidly in population and wealth, at the present time, in proportion to their size, are undoubtedly, Boston and St. Louis, one in the eastern, the other in the western section of the Union. For many years—from 1800 to 1830—Boston was losing ground, in the race for greatness with New York, Philadelphia and Baltimore—but about the year 1830, a new era dawned on that city, through the instrumentality of its enterprising capitalists, which has turned the tide strongly in its favor. At that time the first railroad was constructed on one side of the city, and the first steam power loom establishment erected on the other. From that time to the present, Lowel has increased in population from 200 to 20,000, and in wealth, from $100,000 to $20,000,000. The cotton manufacture of Lowel, and the hundred other manufacturing villages in New England, have given a stability to the trade of Boston, unknown to any other city in the Union.

Massachusetts, which formerly exported, it was said, nothing but granite and ice, now produces manufactures valued at ninety millions of dollars per annum, a large part of which centres at Boston, as a place of distribution to all parts of the Union.

At a later period than that first mentioned, her far-seeing citizens became convinced, that although she had no river like the Hudson, the Delaware, or the Susquehanna, to bring to her wharves the products of the boundless and fertile west, yet that an iron pathway might be laid along her mountain gorges, over which a steam engine with a train of cars could move at the rate of thirty miles per hour, taking the produce of the lakes at the outlet of the New York canal, and landing it at Boston in less time than it can be delivered at New York. About one half of this road is completed, and the whole will be finished within twelve months from this time.

This road will cost not far from seven millions of dollars. It is calculated to support an engine of fourteen tons weight, and to carry 1000 barrels of flour in a single train of cars, ten miles an hour. It is estimated that when finished flour, can be transported from Albany to Boston, 201 miles, for 30 cents per barrel. Two thousand men are now at work on this road, in some sections, both night and day. The capitalists of Boston have also contributed largely to the funds required for laying down railways from Albany to Buffalo, between which places there will soon be a continuous line completed. The same enterprise and capital will, ere many years shall have elapsed, continue the same line across Ohio, Indiana, and Illinois, to St. Louis, in case the funds required for the work are not furnished by the States on the route.

The trade between this city and Boston is greater, and the connexion more intimate, than is generally imagined. The various staple articles of export from Boston, including domestic goods, boots and shoes, oil, candles, &c., required for this market and which are forwarded from here for the upper country, cannot fall short of two millions of dollars.

We shall close these remarks with a comparative statement of the value of western productions shipped from New Orleans to New York and Boston.

	New York.	Boston.
Tobacco,	560,000	160,000
Cotton,	1,880,000	2,120,000
Flour,	228,000	156,000
Pork,	570,000	324,000
Bacon,	109,000	50,000
Lard,	36,000	149,000
Beef,	3,200	11,000
Corn,	15,000	12,000
Lead.	270,000	353,000
Total,	3,371,000	3,334,000

The foregoing, taken from a Boston paper, proves the concert of action between Boston and St. Louis. In a previous communication from a New Orleans paper, surprise was expressed at the apathy of New York, in view of the exertions of Boston, to tap, and take from New York a still larger share of the rich and increasing trade from the vallies of the Ohio the Mississippi and the Missouri rivers.

"Two facts are disclosed, in the "*comparative statement of the value of products, shipped from New Orleans to Boston*" which surprised us. We allude to the value of cotton shipped to Boston (at the close of the last season) exceeding in value, the amount shipped to New York, by $240,000, whilst the previous season it was in favor of New York 12,012 bales, or $480,000.

ADVANTAGES OF COMPRESSED PEAT. By Alexander S. Byrne.

(Continued from page 221)

In a former paper on this subject I omitted to notice a useful application of peat, of considerable importance to persons resident in districts where peat and vegetable *mosses* abound. I allude to the manufacture of beds. For this purpose, mosses are equal in value to the finest feathers; being equally soft and pleasant, more durable, more cleanly, more elastic, and healthful. They are also less costly; for a few shillings the comforts of a good bed can be obtained, superior in many respects to hair or feathers.

The idea occurred to me about twelve monts ago, while exploring the interior of the bogs of Allen; and I immediately tested its beneficial effect, by directing the peasantry of Robertstown to manufacture several large beds and occupy them for a few months. The result has proved highly satisfactory; and, I have no doubt, will induce many of the wealthier classes to provide for the comforts of their poorer countrymen during the inclemency of winter.

The *top* surface of turf lands and bogs consists of strong, fine peat, called *turf moss*, composed of very thin vegetable fibre, delicate, soft and elastic, like whip-cord or strong thread. When properly dried in the open air,

or in drying rooms, and well shaken up, to separate the threads, it will bear considerable pressure without *matting* or losing its elasticity; and there are many reasons for supposing that these properties are retained for a number of years. I have seen thousands of acres that had been exposed to severe trials for a long period of time, without undergoing decomposition. More pleasant and agreeable beds cannot be conceived. They possess all the advantages of horse hair and springs; and from the great softness and elasticity of the fibre, possess the accommodating properties of fine feathers. They are certainly more healthful, because more easily cleansed. Fetid air and unhealthy exhalations from the human body adhere less tenaciously, and it requires less time to cleanse and sweeten them.

In Lapland, the reindeer moss is invariably used for infants to repose on, being softer than any other description of bedding; and in the Cape de Verd islands, a moss somewhat resembling Carrigan moss, (only more thready and fibrous) is generally employed, *by preference*, as a substitute for feathers.

I am not sufficiently acquainted with botany to point out the varieties that are best suited for this purpose; but I have found that almost every description of "top turf," or "bog moss," consisting of thin threads interwoven together, is suited to the purpose when perfectly dried; and I strongly recommend *residents in the back woods* to fill a tick, and make at least one trial with such as they have. I saw some top-surface moss in the woods of Canada, well suited for this purpose, and have no doubt the same description may be found throughout the United States. It would save emigrants both trouble and expense, were such mosses usefully employed, and add much to their comforts.

Some kinds of turf will not answer, owing to their extreme softness and want of elasticity; the heat and moisture of the body causes them to adhere and become matted, or if dried too much, they lose their cohesive properties, become brittle, and break into small pieces like straw. These varieties, however, are the exception, not the general rule. Those who wish to make success more sure will find it advantageous to soak the moss for a few days in a solution of pyroligneous acid, (proportions, 1 pint of acid to 1 gallon of water) or in alum water, (proportions, 1 lb. of alum to 1 gallon water); or a solution of silicate of potash will answer. Corrosive sublimate in solution is still better, or a solution of sulphate of zinc; the former having an astringent quality for binding and preserving the fibre, and the additional property of *coagulating* the vegetable albumen, which materially improves the mosses, and preserves them from rot. It is this property in corrosive sublimate which renders it so valuable in the preservation of timber.

I would here remark in reference to mosses, that when calcined in air-tight retorts, or air-tight vessels of any other kind, with a small aperture for the volatile products to escape, they yield a fine charcoal, which is highly valuable in the manufacture of pigments, tooth powder, and blacking; for which purposes calcined mosses are superior to any other article. They are equally good for such applications after they have been used for bedding.

For the instruction of persons unacquainted with manufactures, I remark, that calcination is effected in vessels heated red-hot, the atmosphere being excluded, and a small aperture left for the gaseous products to escape; when all the gasses are driven off, the process is complete. This may be easily ascertained by applying a piece of lighted paper to the aperture; if it does not ignite, the volatile products have passed off.

One pound of moss or *top turf* charcoal, 1 lb. of treacle, 2 oz. of oil, and

4 oz. of oil of vitriol, mixed with three pints of cider, vinegar, or old beer, makes a blacking equal to the finest lustre. The vitriol should be added after the other ingredients are mixed.

We now resume the consideration of the subjects enumerated in our former paper; and first—the manufacture of iron by means of peat coke.

Charcoal iron, made by means of heat obtained from wood charcoal, is the best known at present in the markets; such is its value and superiority, that large quantities are annually imported into England from India and Sweden, and sold at the enormous price of 36*l* per ton, while English coke iron is sold at one-fifth the price. In considering this part of our subject, we shall endeavor to prove that peat coke *is of greater value* than the best charcoal, and that in the manufacture of iron it stands unrivalled as a fuel. Being a pure vegetable charcoal, it possesses heating properties analogous to wood charcoal, is equally free from those deleterious ingredients which abound in coal; and when properly compressed as recommended by Mr. Charles Williams of Dublin, or Mr. White of London, or as stated in our last paper, two tons of peat coke occupy *the same space* as *one* of charcoal; consequently, where *intensity of heat* is an object, *twice as much heat* can be obtained from peat coke as from the *hardest and closest* charcoal.

Before we enter upon the consideration of this question, we will give the particulars of an analysis of an inferior quality of peat which we gathered from the interior of the bogs of Allen with a view of ascertaining its calorific power. It was made with considerable care, by Mr. Charles Cowper, of the Royal Adelaide Gallery, London, and we have tested the accuracy of his report in several analysis since.

The calorific power was tried by the litharge test, recommended by Berthier, and employed by Mr. Everitt. This consists in mixing a given weight of the fuel with a sufficient quantity of litharge, and heating it in a crucible; the heating power is in proportion to the quantity of lead reduced. Thus, according to Berthier—

10 grs. of pure carbon gives of lead,	340 grs.
10 grs. of good wood charcoal, from	300 to 323 grs.
10 grs. of dry woods, from	120 to 140 grs.
10 grs. of good coke, from	260 to 285 grs.

According to Mr. Everitt's experiment—

10 grs. of peat coke, picked surface, gave	277 grs.
10 grs. of peat coke, *lower* strata	250 grs.
10 grs. of pressed peat	137 grs.

By Mr. Cowper's experiments, the following results were obtained, being averages of six or eight experiments each:

10 grs. of good Newcastle coal gave	284 grs.
10 grs. of oven coke	302 grs.
10 grs. of common peat	144 grs.
10 grs. of same, coked in a crucible	259 grs.

For the information of those who are unacquainted with this subject, we would observe that the foregoing analysis is founded upon a well known fact—that the quantity of heat generated during the combustion of any fuel is in exact relation to the quantity of oxygen consumed in the process; it being ascertained that *oxygen* supports combustion. Hence, in order to ascertain the relative calorific powers of fuels, *it is only necessary to ascertain the quantity of oxygen each consumes in burning.*

By an average of two experiments made in a platinum crucible, the peat was found to yield 37½ per cent of coke, and 3⅜ of ash; and the coke,

9 per cent of ash. The coke is light and friable, and the peat does not swell in coking like Newcastle coal. Thus, it will be seen that two tons of ordinary *uncompressed* peat are equal to one ton of Newcastle coal, and 7 tons of peat coke are equal to 6 tons of good coal coke. The coke gives about two-thirds as much heat as the peat from which it is obtained. It should however be remembered, in comparing peat coke with coke obtained from coal, that two tons of the former, when made from *compressed* peat, occupy the same space as one and a half of the latter; consequently the amount of heat present in the same furnace would be nearly one third more, beside which peat coke is always free from sulphur and other deleterious matter so noxious to the smelter.

As wood charcoal is on many accounts superior to coke from coal in the manufacture of iron, we will not allude further to the latter, but confine our observations as much as possible to the former, in order to ascertain the true value of peat coke.

Prof. Everitt gives the following statement of his experiments in reference to this point, which, he observes, were made with great accuracy; and as the result of our own experiments correspond so nearly with his, we prefer giving his report as an authority. The density (or specific gravity) of

Water,	1000
Compressed peat,	1160
" " less pressed,	910
Peat coke, hard pressed,	1040
" " less pressed,	913
Hardest and dry woods (such as oak, etc.)	800 to 835
Lighter woods (such as poplar, pine, etc.)	383 to 530
Charcoal from hard woods,	400 to 625

Hence we see that the hardest compressed peat is denser than the hardest woods in the relation of 1160 to 835; and compared with some of the lighter woods, nearly double. Further, that the coke prepared from compressed peat is nearly double the density or ordinary charcoal. In common practice it is reckoned that 100 lbs. of charcoal occupy the same space as 200 lbs. of coke. Peat coke would occupy, weight for weight, the same space as common coke.

Pofessor Everitt further remarks: "From my trials, I am of opinion;—1. That the peat coke examined by me (common Lancashire turf,) contains nothing which would, during the burning, be more injurious to iron than *wood charcoal* or the *best* coke, whether it be used to work iron, or under boilers for the generation of steam—2. That it is equal to *the best coke*, weight for weight; and in heating power a little inferior, weight for weight, to wood charcoal, where quantity of each is the only consideration; but where bulk of stowage and *high intensity of heat** are important considerations, it is *superior* to wood charcoal."

The peat examined by Prof. Everitt was common Lancashire peat; but I have found numerous tracts which excel it in purity and calorific power, and contain a much smaller proportion of combustible matter. I have also frequently compressed peat, by means of a stamper press and the use of heat, to a density exceeding that examined by Everitt in the proportion of 1359 to 1160; the density, therefore, of peat coke may be proportionably increased, in relation to ordinary charcoal, as 1120 to 500.

It must be evident from the foregoing remarks, that peat coke is of greater value in the manufacture of iron than the best wood charcoal, (*unless by*

*In smelting iron, this is the chief consideration.—A. S. B.

softening wood, compression to the same density couldb e attained) affording, as I have clearly shown, the important property of high intensity of heat in a small space, and the absence of all deleterious mixtures. Its advantages in this branch of trade should arouse public attention, and induce possessors of turf lands to bring this kind of coke into general use.

But in the manufacture of iron it is not necessaay to coke or compress peat in order to use it benficially, as on account of its purity and density it is equal to wood charcoal, and in some respects superior to coal. We have seen it used in forges and in blast furnaces with the greatest advantage. Henry Scale, Esq., one of the proprietors of the Aberdare iron works, Glamorganshire, informed us that successful experiments had been made in Wales. Mr. William Jones, furnace manager at Mr. Crawshay's works, Hirwain, in the same county, and Mr. Taylor of Hirwain, (both eye-witnesses) informed us, that in the year 1838, a trial of peat in its natural state was made at the Hirwain iron works, near Aberdare, to ascertain its value in smelting iron. The proportions were about four-fifths of common coke from coal and one-fifth of peat. Now mark the results: The quality of the iron produced was *cast* iron, "First Foundry," (called No. 1 Foundry.) The trial was continued for a few days with equal success; but as there is little peat in that district, it was not followed up, for fear of giving an advantage to manufacturers residing in peat counties.

The quality of the iron previous to the application of the peat was what is technically called "white iron," the most inferior description; but the result of the experiment was the production of "gray iron," of a highly carburetted character, technically called "foundry." The peat was of the black class, and used as it came from the bog, many portions being quite wet.

We heard in a letter from Mr. John Evens, of (Sir John Guest's) Dowlas iron works, that Mr. W. Daniell, of Abercarn, occasionally used peat in his chaferies, in lieu of charcoal. We addressed him a letter, and received the following answer:—

Dear Sir:—In reply to yours of the 24th inst. I remark, the mode I used peat was mixed with charcoal, say two-thirds charcoal and one-third dried peat. I made the *very best iron* for tin plate. The iron was made in a finery. I think it possible *to use peat alone.* I have not seen any of the Irish peat compressed, and therefore cannot give an opinion whether it can be used in blast furnaces to advantage or not.

I am, dear sir, your ob't. serv't.,

William Daniell.

Perhaps one reason why good peat is preferable to any other article in smelting iron ores, welding, softening steel plates, etc. is, that the excess of carburetted hydrogen known to exist in such substances, and the quality of the gaseous products generally act more readily upon metalic bodies. It is certain that iron works more "kindly," as it is termed, and is sooner brought to a welding heat by the use of peat than with any other fuel.—*American Repertory.*

EARTHQUAKE IN CONNECTICUT, &c.

On Sunday, August 9, 1840, a shock of an earthquake was distinctly perceived in many parts of Connecticut, and at Hartford was so severe as to cause considerable alarm, especially in the churches in which many people were assembled, and out of one of them they rushed with precipitation.

"In New Haven it was not perceived at all by the people assembled in

the churches, and the trembling was slightly felt by one or two persons in their own dwellings. In one house two persons lying down were aroused by the shaking of the bed and the rattling of the window blinds; the house is of brick. At North Milford, six miles west of New Haven, it was not perceived. At Milford, still further west, and at Bridgeport, it was felt and heard distinctly Hence we hear of it to the north and northeast, as very distinct in a part at least of Derby, in Waterbury, Middlebury and Woodbury, nine to twenty-five miles from New Haven; and still more distinctly, it is reported, in Washington, yet in Watertown it was not noticed at all. Further north, we trace it through Farmington and Simsbury, ten and fifteen miles from Hartford. The report is, that it was not observed in Hartland and other towns in the north of Litchfield county. It was very perceptible in some parts of Massachusetts—not at all in Westfield. In Worcester county it was severe. In Boston there was nothing of it. It extended into Tolland county, in this State. Between Hartford and New Haven, it was severely felt in Meriden, not at all in Wallingford, nor we believe at Berlin. At Middletown there was a slight shock. From most of these places we have our information direct, yet it is probable that in some cases in which our informant had not noticed it or heard of it, it may have been perceived by others in the neighborhood.

"The noise was thought by some to proceed from east to west, and by others from northeast to southwest.

"We learn also that the shock was noticed distinctly at Clinton, about twenty-five miles east of New Haven, also at Woodbridge and Wolcott. The noise is compared by different persons to the roll of thunder, the rumbling of a carriage, and the roar of a chimney on fire."*

Some persons have been disposed to attribute this earthquake to the explosion of a meteor. It is true that the explosion of meteors does sometimes produce this effect, as happened Feb. 2, 1766, in Rhode Island and Massachusetts, and at Charleston, South Carolina, in November of the same year, and remarkably at Weston, Connecticut, December, 1807. But there is in the present case no distinct evidence of the transit of a meteor, no such body having been observed,† nor have any fragments been reported as having fallen from the atmosphere.

The great seat of American earthquakes being on the western side of the continent, comparatively few events of this nature have been observed on the eastern side since Europeans have become acquainted with the western hemisphere.

An interesting account of the earthquakes of New England was given to the American Academy of Boston by Prof. Williams, in the volume of their Transactions for 1785, and the remarkable facts described in it might well form the subject of a distinct notice, for which we have not now room. What we have at our disposition shall be devoted to a scene of local disturbance in Connecticut which has been observed ever since the settlement of the country. The region is around East Haddam, on the Connecticut river, a few miles below Middletown. The following memorandum was by request communicated to the senior editor of this Journal twenty five years ago, by the late Rev. Henry Chapman,‡ and it has been kept on file with the expectation of making an investigation on the spot; but, as that which has been so long delayed may never be done, we are induced to give the fragment on the present occasion.

* Hartford and New Haven Congregational Observer.

† The atmosphere was clear, and the sun shining bright, which might have rendered a fiery meteor invisible, unless its ignition had been very intense.

‡ Who died in Arkansaw, as a missionary.

"In attempting to give an account of the circumstances attendant on subterranean noises, so frequently heard at East Haddam, perhaps it may be proper to mention the common opinion respecting them.

"East Haddam was called by the natives Morehemoodus, or *place of noises*, and a numerous tribe of cannibals resided there. They were famous for worshipping the evil spirit, to appease his wrath. Their account of the occasion of the noises is, 'that the Indian god was angry because the English god intruded upon him, and those were the expressions of his displeasure.' Hence it has been imagined that they originated after the arrival of the English in this country.

"About fifty years ago, an European by the name of Steele came into the place and boarded in the family of a Mr. Knowlton for a short period. He was a man of intelligence, and supposed to be in disguise. He told Mr. Knowlton in confidence, that he had discovered the place of a fossil which he called a carbuncle, and that he should be able to procure it in a few days. Accordingly, he soon after brought home a white round substance resembling a stone in the light, but became remarkably luminous in the dark. It was his practice to labor after his mineral in the night season. The night on which he procured it he secreted it in Mr. K.'s cellar, which was without windows, yet its illuminating power was so great that the house appeared to be on fire, and was seen at a great distance. The next morning he enclosed it in sheet lead, and departed for Europe, and has never since been heard of. It is rumored that he was murdered on his way by the ship's crew. He said that this substance was the cause of the noises—that a change of temperature collects the moistness of the atmosphere, which causes an explosion.

"He further observed, that there would be no more noises for twelve or fifteen years, and then they would be heard again in consequence of the explosion of some small pieces of this substance which he had left, which would by that time become sufficiently large to produce the effect. It is reported that his prediction was strikingly fulfilled. These circumstances are currently reported, and as they are recollected and often spoken of by many respectable old people, they are generally believed.

"Perhaps these stories may only serve as instances of public credulity, but as they are in the mouth of every one who says any thing about this subject, I thought it might not be improper briefly to communicate them.*

'These shocks are generally perceived in the neighboring towns, and sometimes at a great distance. They begin with a trembling of the earth, and a rumbling noise nearly resembling the discharge of very heavy cannon at a distance. Sometimes three or four follow each other in quick succession, and in this case the first is generally the most powerful.'

"While I was pursuing my inquiries concerning this subject, I was so fortunate as to find a register, in which was recorded a collection of observations on the state and changes of the atmosphere, the tides, and in short the most remarkable occurrences of the last thirty years, which were noted at the time, with some of the attendant circumstances. From this I copied in short notes an account of the Moodus noises since that period, which I here subjoin in detail.

"The first which was recorded occurred on the 16th of May, 1791. It began at 8 o'clock, P. M. with two very heavy shocks in quick succession. The first was the most powerful; the earth appeared to undergo very violent convulsions. The stone walls were shaken down, chimnies were un-

* It is almost unnecessary to say, that these foolish stories are deserving of no credit whatever, and they are here preserved only as a part of the legends of the day.—Eds.

topped, doors which were latched were thrown open, and a fissure in the ground of several rods in extent was afterwards discovered. Thirty lighter ones succeeded in a short time, and upwards of one hundred were counted in the course of the night.

"This shock was felt at a great distance. It was so severe at Killingworth, (about twenty miles distant,) that a Capt. Benedict, who was walking the deck of his vessel, then lying in the harbor of that place, observed the fish to leap out of water in every direction as far as his eye could reach.

"The atmosphere was perfectly clear and pleasant, and the moon, which was near its full, shone remarkably bright. On the night of the 17th, six more were observed. The atmosphere was still clear and warm.

"The next occurred August, 28th, 1792, at 10 o'clock, P. M. Rain in the forenoon, wind at the eastward. In the afternoon the wind was southwest. Warm and somewhat squally.

"October 24th, 1792, at 1 o'clock in the morning, occurred three shocks. Very pleasant weather—wind southwest.

"Another was observed on the 11th of January, 1793, at 8 o'clock, A. M. The weather was very pleasant and warm. It thawed.

"There was another on the 6th of July, at 6 o'clock in the morning. Very warm and damp. Rain with thunder in the afternoon.

"March 9th, 1794, at 2 o'clock, P. M. there were two, and a third at 11 o'clock, P. M. The atmosphere was clear in the morning, hazy and damp in the afternoon.

"Two others were observed on the 11th of August, 1805, at 7 o'clock, P. M. Wind southwest in the forenoon, and a thunder storm about 4 o'clock, P. M.

"Another occurred on the 30th December, at 6 o'clock, A. M. The atmosphere was moist.

"There were two others on the 9th of February, 1812, at 9 o'clock in the forenoon. Weather was clear, and the wind southerly.

"Another was observed on the 5th of July, at 8 o'clock in the forenoon. The atmosphere was filled with rain and mist.

"The last was on December 28th, 1813, at 4 o'clock in the afternoon. The weather was damp, and thawed the snow fast.

"This account has been several times interrupted by the ill health of the gentleman who kept it. These periods have been frequently of considerable length, and in all probability in these intervals many of these occurrences were omitted.

"The particular place where these explosions originate, has not been ascertained. It appears to be near the northwest corner of the town. It was near this place that Steele found his fossil. The place where the ground was broken when the first one occurred which I mentioned above, was about three and a half miles from this place. There was no appearance of a deposit near where the ground was broken, but it has been observed that this place has been repeatedly struck with lightning.

"The above is the amount of the information which I collected on this subject. I am conscious of the insignificance of some of it; but these stories were blended with all the virtual information which I could find. For this reason I have written them."

The Haddam earthquakes were described more than a century ago by the Rev. Mr. Hosmer, of Haddam, in a letter to Mr. Prince, of Boston, dated Aug. 13, 1729, and recorded in Trumbull's History of Connecticut, (Vol. II, p. 92,) from which the following passages are extracted: they have the tinge of the times, which only adds to their credibility.

"As to the earthquakes," he observes, "I have something considerable

and awful to tell you. Earthquakes have been here, (and no where but in this precinct, as can be discerned; that is, they seem to have their centre, rise and origin among us,) as has been observed for more than thirty years. I have been informed, that in this place, before the English settlements, there were great numbers of Indian inhabitants, and that it was a place of extraordinary *Indian pawaws*, or in short, that it was a place where the Indians drove a prodigious trade at worshipping the devil. Also I was informed, that, many years past, an old Indian was asked what was the reason of the noises in this place? To which he replied, that the Indian's God was very angry because Englishman's God was come here.

"Now whether there be any thing diabolical in these things, I know not; but this I know, that God Almighty is to be seen and trembled at, in what has been often heard among us. Whether it be fire or air distressed in the subterraneous caverns of the earth, cannot be known; for there is no eruption, no explosion perceptible, but by sounds and tremors, which sometimes are very fearful and dreadful. I have myself heard eight or ten sounds successively, and imitating small arms, in the space of five minutes. I have, I suppose, heard several hundreds of them within twenty years; some more, some less terrible. Sometimes we have heard them almost every day, and great numbers of them in the space of a year. Oftentimes I have observed them to be coming down from the north, imitating slow thunder, until the sound came near or right under, and then there seemed to be a breaking like the noise of a cannon shot, or severe thunder, which shakes the houses and all that is in them. They have in a manner ceased, since the great earthquake. As I remember, there have been but two heard since that time, and those but moderate."

Dr. Trumbull, without giving an exact date, goes on to remark in his history: "A worthy gentleman, about six years since, gave the following account of them."*—"The awful noises, of which Mr. Hosmer gave an account, in his historical minutes, and concerning which you desire further information, continue to the present time. The effects they produce, are various as the intermediate degrees between the roar of a cannon and the noise of a pistol. The concussions of the earth, made at the same time, are as much diversified as the sounds in the air. The shock they give to a dwelling house, is the same as the falling of logs on the floor. The smaller shocks produced no emotions of terror or fear in the minds of the inhabitants. They are spoken of as usual occurrences, and are called Moodus noises. But when they are so violent as to be heard in the adjacent towns, they are called earthquakes. During my residence here, which has been almost thirty-six years, I have invariably observed, after some of the most violent of these shocks, that an account has been published in the newspapers, of a small shock of an earthquake, at New London and Hartford. Nor do I believe, in all that period, there has been an account published of an earthquake in Connecticut, which was not far more violent here than in any other place. By recurring to the newspapers, you will find, that an earthquake was noticed on the 18th May, 1791, about 10 o'clock, P. M. It was perceived as far distant as Boston and New York. A few minutes after there was another shock, which was perceptible at the distance of seventy miles. Here, at that time, the concussion of the earth, and the roaring of the atmosphere, were most tremendous. Consternation and dread filled every house. Many chimnies were untopped and walls thrown down. It was a night much to be remembered; for besides the two shocks which

* As the venerable historian placed the MS. of his second volume confidentially in the hands of the senior editor of this Journal in the year 1810, the letter alluded to above must have been written about the beginning of the present century.

were noticed at a distance, during the night there was here a succession of shocks, to the number of twenty, perhaps thirty; the effects of which, like all others, decreased in every direction, in proportion to the distances. The next day, stones of several tons weight, were found removed from their places; and apertures in the earth, and fissures in immovable rocks, ascertained where the explosions were made. Since that time the noises and shocks have been less frequent than before; though not a year passes over us but some of them are perceptible."

It appears that the earthquake was perceived at Middle Haddam on the present occasion. The country in that region is of granite, gneiss, and other primary rocks, and has during many years been famous for its fine crystallized minerals,—beryl and emerald, chrysoberyl, tourmaline, garnet, columbite, &c. Its numerous quarries afford the most magnificent slabs of hornblende gneiss for pavements, and supply distant parts of the United States; and porcelain feldspar has been obtained there by hundreds of tons for exportation. A few miles above, (north,) the primary changes to red sandstone, with trap; and near this junction is a lead mine, formerly wrought, but now abandoned. A trap dyke of vast extent intersects the country, running from the coast at Guilford a great way inland.

In Middle Haddam, near the centre of the well known Moodus noises, "the shock was quite severe." The direction was thought to be from west to east, but not exactly in a line with the stratification of the country. The above remark is quoted from an observer by the Rev. Mr. Brewer, late missionary in Smyrna.* The same gentleman adds the following facts. Being at Chester on the day of the earthquake, (August 9,) a few miles below East Haddam, on the Connecticut River, he observed the jar to be equal in violence to one half of some 15 or 20 shocks to which he had been annually accustomed for a course of years in Smyrna. He thinks that the rumbling may have continued half a minute, and that its course was from N. W. to S. E., nearly in the direction of the strata. It was perceived at Westbrook, Haddam and Wethersfield.

Mr. B. thinks that the earthquakes in Connecticut all proceed from the Moodus Hill, called Mount Tom. He observes that Smyrna was destroyed by an earthquake A. D. 177, and that the catastrophe has been several times repeated, "but generally speaking, its numerous annual earthquakes extend over a circumference of probably not more than 20 or 30 miles, and are ordinarily so slight as barely to arouse one out of sleep, and seldom if ever does any rumbling accompany the shock." "Besides their limited extent, there are hot springs about five miles from the city, under the foot of Mount Corea, which go to prove them of local origin."

Nothing has, we believe, been suggested regarding the cause of the Haddam convulsions, worthy of confidence. The old story of fermenting or decomposing pyrites has been repeated, but this cause seems quite inadequate to account for movements extending at intervals through centuries.

ACCOUNT AND DESCRIPTION OF YOUGHAL BRIDGE, DESIGNED BY ALEXANDER NIMMO. By John E. Jones, A. Inst. C. E.

Youghal, a town in the south of Ireland, county of Cork, celebrated as being the place in which the potatoe was first planted in Irish soil, by Sir Walter Raleigh, is a sea-port of considerable trade, situated on the river Blackwater, which separates it from the adjoining county of Waterford.

Until the building of the present bridge, a dangerous ferry of nearly half

* In the Hartford and New Haven Congregational Observer, of Aug. 29, 1840.

a mile was the only means of communication at this point between the two counties, except by going a distance of sixteen miles by the bridge of Lismore.

The erection of a bridge, which had been for many years in contemplation, was at length decided upon by the principal inhabitants of Youghal, and the late Mr. Nimmo, then employed as government engineer in Ireland, was applied to. He accordingly gave two designs, one for a suspension bridge at Rencrue, where the river narrows, the other, a timber one, within a mile of the town; the latter was preferred for many reasons, viz.: from its requiring an embankment to be made to low water mark, a distance of fifteen hundred feet, forming one side of a triangle, which, when completed, would enclose a tract of ground nearly four hundred acres in extent, and would also save much trouble and difficulty in forming the new line of road to join the old one leading from Waterford to Cork; but principally from its economy, there being ten thousand pounds difference in the estimates.

It was commenced in the year 1829 under my superintendence, and finished in the year 1832.

DESCRIPTION OF BRIDGE.

Its site is upon an arm of the sea, which forms the mouth of the river Blackwater, the rise and fall are sixteen feet each tide, the rapidity of the flow being so great as to increase one half its height in the first quarter.

There are two channels, east and west, separated by a bank of sand, the tail of which passes under the centre of the bridge and is scarcely covered at low water. The quay on the Waterford or western side is two hundred feet square, and its channel upwards of twenty feet deep at the lowest spring tides; from this circumstance it was considered the best place for the bascule, which was for the accommodation of the larger trading vessels, the smaller being enabled, like those on the Thames, to pass under by lowering their masts. The embankment on the eastern side is fifteen hundred feet in length. The face walls are built in good dry rubble work, varying in height from two to twenty feet, along which line there is a belting course laid in mortar, to support the parapet, which is four feet high and two feet thick, that next the sea having a curved batter of six inches to the foot; the upper face two inches to the foot; top of the wall is two feet six in breadth, with counterforts five by four and ten feet apart; the road is thirty feet broad, and there is a footpath on either side of six feet.

The foundation for the walls was formed by placing a heap of loose stones about six feet in depth along the entire line; upon this were deposited the materials for the future wall. This weight sunk the stones a considerable way into the sand. The filling was thrown in, and the whole allowed to remain in that state for twelve months, during which time, if any part of it sank, there was more added, until it at last became one firm mass. The temporary walls were then taken down and rebuilt, according to the section given in the drawing.

The bridge unites with the embankment at low water mark, and is 1542 feet in length; it is composed of 47 bays of 30 feet span. The bascule and its piers 80 feet and 52 feet, the space occupied by the piles making the total length of timber work 1542 feet. Its breadth is 22 feet, and height above high water 10 feet, which makes a variation in the length of its piles from 36 to 70 feet; those I have drawn are the two extremes as far as the depth of the piles in the ground, but are shown in 15 feet water.

The timber is of crown brand Memel, selected by one of the contractors who went there for that purpose. The beams were 14 inches square, and

in length from 44 to 90 feet; the specification only required that the piles, caps, and all the larger timber, should be 12 inches square, but the contractors did not reduce it, though they were aware it would have paid very well for its sawing. Mr. Nimmo, in his specification, allowed the piles to be scarfed, which however was not necessary, as long as the selected timber lasted, but from not having imported quite enough, they were obliged to have recourse to this method, not being able to get any of sufficient length in either Cork, Youghal, or Waterfood. The quantity of timber used was nearly as follows:

	Tons.
Hand Railing,	69
Flooring,	220
Joists,	164
Bolsters,	30
Caps,	26
Piles and in breakers,	420
Struts and straining beams,	105
High and low water gauge beams,	60
Diagonal beams,	38
Total number of tons,	1132

The dimensions of the gauge beams, diagonal braces, caps, bolsters, joists, struts, straining beams, purlin beams, and flooring, etc. etc. are given in the large elevations and sections.

The caps are fastened to the heads of the piles by an oaken coke three inches in diameter and six in length, through which an inch and a quarter iron bolt is driven. At each side of the high water gauge beams, there is an iron strap three inches broad and half an inch thick thoroughly bolted. There are also three tailed straps at the joining of the struts and straining beams.

In the specification it was said the piles were to be driven ten feet at least, or until they did not move an inch after receiving twenty blows of an iron ram five cwt. falling ten feet; however, upon driving the piles which formed the first pier, I found that the bottom was so soft, that their own gravity sunk them five or six feet, and that it required very little additional power to drive them the remainder of the ten feet! Upon applying to Mr. Nimmo, he said his idea was, that ten feet would have been enough for the piles to go into the ground, and that it was only in cases where they would not go that depth that he specified otherwise. This circumstance, as well as my observing that the narrowing of the river by building the embankment on the eastern side had caused a washing away of the bottom, induced me to recommend the commissioners to pay an additional sum to the contractors for driving the piles as far as they would go, which proved to be in many instances 25 feet. In cases where the ground was at all hard, the piles were shod with iron, as I have shown.

The quay wall is four feet six at the top, and twenty-six feet high, battering two inches to the foot, with counterforts four by eight, and ten feet apart.

There are two toll houses and about three miles of new road, which comprises all the works connected with this bridge.

The entire length is as follows:

	Feet.
Embankment,	1500
Timber work,	1542
Quay wall,	200
Total,	3242

The expense was under 18,000*l*, but it could not have been done for any thing like that sum, had it not been near one of the finest quarries in Ireland.—*Trans. of the Inst. of Civil Engineers.*

JOHN JONES, C. E.

The following decision of the Superior Court of Connecticut, is copied from the Hartford Courant.

Hooker vs. *New Haven and Northampton Co.*—This was a case involving principles interesting to many corporations, and particularly to persons interested in and affected by the Farmington canal.

The plaintiff brought his action on the case against the defendants, proprietors of the Farmington canal, for damage done to his land by water discharged at sundry times, in great quantities and with great force, from a waste wier of the canal, by which a deep and wide chasm was excavated in his land, and a part of the same rendered inaccessible. The defendants did not deny that the injury had been done by the action of the canal water and in consequence of the manner in which their works had been constructed according to the surveys, as approved by the commissioners.

The defendants claimed a right under their charter to let off all water necessary for the safety of the canal, without any liability for any damages whatever that might be done.

Judge Sherman charged the jury to the effect that there is no redress for such injuries, where a corporation are in the discharge of their appropriate duties; and that if the Canal Co. have done nothing not necessary for the safety and well-being of the canal, they are not liable for any injuries whatever to the property of others, resulting from the acts in question.

The jury thus instructed, brought in a verdict for the defendants.

ELECTRIC TELEGRAPH.—A telegraph worked by electricity is in operation on the great western railway between Drayton and Paddington in England, by which news is conveyed at the rate of two hundred thousand miles per second, or eight thousand times quicker than light travels during the same period. Electrical currents passing through coils of copper wire placed immediately behind some magnetic needles are made to operate upon a circular series of twenty letters, which indicate such terms, either separately or collectively, as they have been arranged to represent. This telegraph will act day and night, in all states of the weather and with such rapidity that one minute only is required for the communication of thirty signals.

SELF ADJUSTING RAILROAD CAR.—A gentleman called on us yesterday with a model of a new railroad car, with six wheels, with the frame so arranged that any curve, say of thirty feet radius, may be turned without friction in the outer rail of the road. The construction of this car is such as to allow a train to pass a curve of three hundred feet radius at the highest speed without injury to car or rails, and without any perceptible friction. The model may be seen at the Franklin Inititute during the present week, and we hope that those who can judge of the merits of such inventions will call and examine for themselves. The Columbia Railroad will afford a very fair trial for cars on this principle.

CLOTH OF GLASS.—Messrs. Williams and Sowerby of London, have been exhibiting, at the Annual Show of the Polytechnic Institution, (London,) their process by which glass first spun by steam power, is woven by the loom into those sumptuous tapestries and rich hangings, which have excited the astonishment of all beholders. This curious manufacture alone is worth a visit to the Institution.—*Atheneum.*